

CROCODILE CONSERVATION, WESTERN ASIA REGION: AN UPDATE

(With three text-figures and two plates)

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Crocodile conservation began in earnest in the mid 1970s when all the three South Asian species — the gharial (*Gavialis gangeticus*), mugger (*Crocodylus palustris*) and saltwater crocodile (*Crocodylus porosus*) were near extinction. The Government of India assisted by FAO/UNDP eventually established 13 sanctuaries for crocodile conservation in India and thousands of gharial, mugger and saltwater crocodiles, reared from wild collected eggs, were released in the wild. Unfortunately, the energy and enthusiasm for crocodile conservation has all but vanished. Sri Lanka has more wild mugger than the rest of South Asia combined and a small mugger population survives in Iran. Pakistan and Nepal have very few mugger and gharial left, while in Bhutan they are all but extinct. The Madras Crocodile Bank houses the largest gene pool of mugger as well as breeding groups of gharial and saltwater crocodiles.

Conservation of crocodiles in South Asia through sustainable use is seen as the strategy that could save the three species in the long run, since protection on paper does not appear to be working.

INTRODUCTION

At the best of times in human history, crocodiles have not been very popular. True, they appear in myth and religion: Ma Ganga, the Ganga river goddess, rides a mugger and the crocodile monster is Makara, the carrier of Varuna the rain god. Yet, then as now, the crocodile was feared, reviled and killed when possible — and killed they were — throughout the Indian subcontinent, the Andaman and Nicobar Islands and Sri Lanka. Some of us did surveys in the early 1970s and confirmed reports from even the remotest areas that India's three crocodilians were indeed going extinct, due to hunting and habitat loss (Biswas 1970, Whitaker 1974a, b, Whitaker and Daniel 1980). In the mid 1970s, two initiatives were made toward saving the gharial *Gavialis gangeticus*, the mugger *Crocodylus palustris* and the saltwater crocodile *Crocodylus porosus*. One was the large-scale GOI/FAO/UNDP Crocodile Conservation

Project that covered all crocodilian states in India, and the other was a private trust, the Madras Crocodile Bank.

Thanks to the work, interest and enthusiasm of an array of people from skilled boatmen to unfortunate bureaucrats behind desks, from keen young students and forest officers to overseas consultants and Ph.D. scholars, India's three spectacular crocodilians were yanked back virtually from the brink. This was one of the world's conservation success stories. Now it is time to evaluate what the Project achieved and why it came to a grinding halt.

THE INDIAN CROCODILE CONSERVATION PROJECT

In 1974, a consultant from the Food and Agriculture Organization (FAO) of the United Nations Development Programme (UNDP), H.R. Bustard was invited by the Government of India (GOI) to look at the crocodile situation in India (Bustard 1974). Backed by survey reports by Indian workers, Bustard drafted an FAO project document for the GOI, that spelled out an egg collection, rear and release programme with a plan to establish protected areas at suitable locations. The project included research, training and even involvement

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of the local people to protect their interests and to include them in village level commercial crocodile farming and ranching (Singh 1999a).

Since the project began more than 25 years ago, thousands of gharial, mugger and salties have been reared, mainly from wild collected eggs, at special rearing centres. As a result of the GOI/FAO/UNDP Project, 13 sanctuaries totalling over 8,000 sq. km were created for crocodile conservation in India. Twenty-one other protected areas provide incidental protection to remnant natural populations and restocked crocodiles. Over nine thousand gharial, mugger and saltwater crocodiles have been released at more than 30 sites throughout the country.

Results of the releases have been mixed. For example, most of the 142 mugger released in Krishnagiri Reservoir, Tamil Nadu in 1985 were killed off within 2 years (V.M. Narasimhan, pers. comm.). Of the 150 mugger released in the Anamalai Wildlife Sanctuary, only three animals were traceable by 1992 (Choudhury 1986, Satheesh 1992, Andrews 1999b). The 700 juvenile gharial released in the Satkosia Gorge Sanctuary on Mahanadi river in Orissa mostly vanished (Singh 1991, 1999b). The saltwater crocodiles released in Andhra Pradesh during 1978 also vanished due to anthropogenic pressures (Srinivas *et al.* 1999). On the other hand, gharial releases in the Chambal river and saltwater crocodile releases in Bhitarkanika have been successful.

This unique species, once almost on the verge of extinction, has made a major comeback since the 1980s. Whitaker and Basu (1979) estimated less than a hundred gharial (*Gavialis gangeticus*) in the wild. Since then, of the 4,330 gharial reared at Kukrail centres in Uttar Pradesh state, 3,495 were released (Singh *et al.* 1999). In Madhya Pradesh, 250 have been released since 1985 into the Chambal, Ken and Son river systems. During the 1995-1997 surveys of the National Chambal Sanctuary (Rajasthan, Madhya Pradesh and Uttar Pradesh) 1,214 gharial were counted, with an adult (Plate 1, Fig. 1) male to female ratio of 1:3.6. A total of 75 nests were also located, all of which indicates that the gharial population is recovering (Rao *et al.* 1995, Rao 1999, Sharma 1999). The current gharial status is shown in Table 1. Next to the Chambal Sanctuary, Katerniaghat Sanctuary, also in Uttar Pradesh, has the second largest wild gharial population. However, this population is currently facing the threat of extinction due to habitat pressure and inadequate recruitment. The remaining gharial sites in India have 50 or fewer animals.

In particular, the new Indian state of Uttaranchal, along with Rajasthan and Madhya Pradesh hold the world responsibility of the welfare of the largest wild gharial population. The Chambal river is the last bastion of the gharial and a wide array of river life. Any designs to

Table 1: Total wild gharial in India

Location	Estimated numbers released	Estimated wild gharial
National Chambal Wildlife Sanctuary:		
Rajasthan = 0		
Madhya Pradesh = 57		
Uttar Pradesh = 3,495	3,552	1,240 (based on surveys)
Katerniaghat Sanctuary, Uttar Pradesh	?	100 (guesstimate)
Corbett National Park, Uttar Pradesh	?	30? (no recent data)
Ken/Son rivers, Madhya Pradesh	193	50 (based on surveys)
Arunachal Pradesh	?	10? (no recent data)
Orissa	700 +	35 (based on surveys)
Total	4,445 +	1,465 +/- 200

Source: ENVIS (Wildlife & Protected Areas) (2)1, 1999.

tamper with this river system for so-called “development” and “betterment of the people” must be thwarted.

In northeast India, gharial are near extinction, with an estimated population of 10 individuals (Choudhury 1997). The same author has reported breeding in isolated areas, besides individual specimen sightings in Siang, Subansiri and the Noa-Dihing rivers, tributaries of the Brahmaputra. There is an urgent need for conservation and management action in this state. Surplus gharial in captivity from the states of Uttar Pradesh or Orissa can be transported and released in protected areas such as D’Ering Memorial Sanctuary and Namdapha National Park, and an efficient monitoring system set in motion.

The West Bengal Forest Department has reintroduced gharial into Thorsa and Teesta rivers on an experimental basis, encouraged by historical accounts of the presence of this species in the state (Srinivas *et al.* 1999). The historical and current distributional range of the gharial is shown in Fig. 1.

Gharial outside India

In Nepal, gharial were once distributed throughout the width of the country in all the major river systems and their tributaries. Currently there are only small, isolated populations in the Karnali, Babai, and the Narayani river systems, all of which are in, or adjacent to, protected areas (Maskey and Mishra 1981, Andrews and McEachern 1994, Maskey 1999). Since 1981, 432 gharial have been released and 70 more in 1993 (Andrews and McEachern 1994, Maskey 1999). The current estimated population in the wild is 105 individuals distributed in seven rivers (Maskey 1999). Conservation efforts started in 1978 are still under way through an egg collection, rear and release programme.

The gharial populations in Pakistan, Bhutan, and Bangladesh are near extinct and probably not viable. Estimated populations are

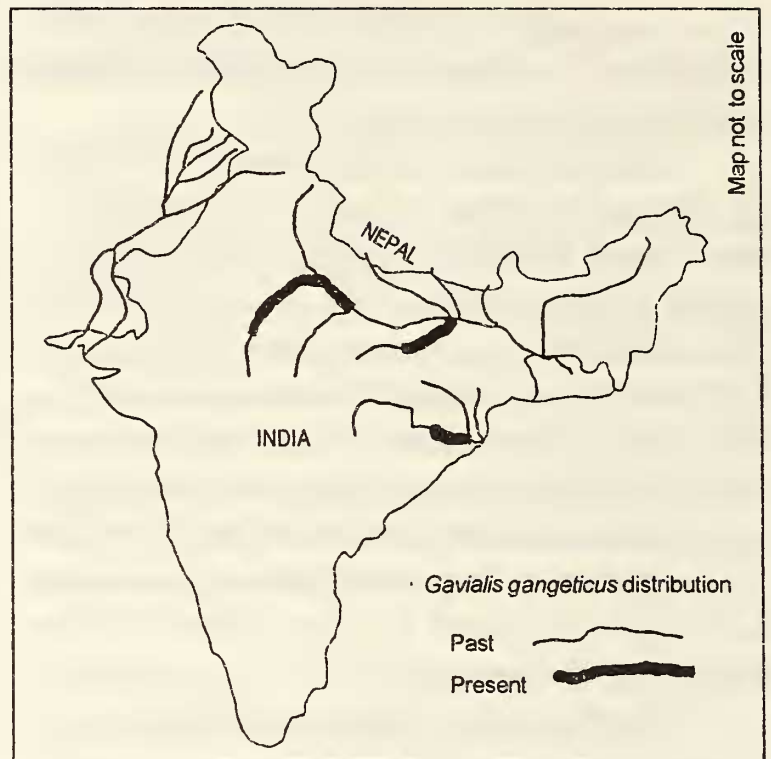


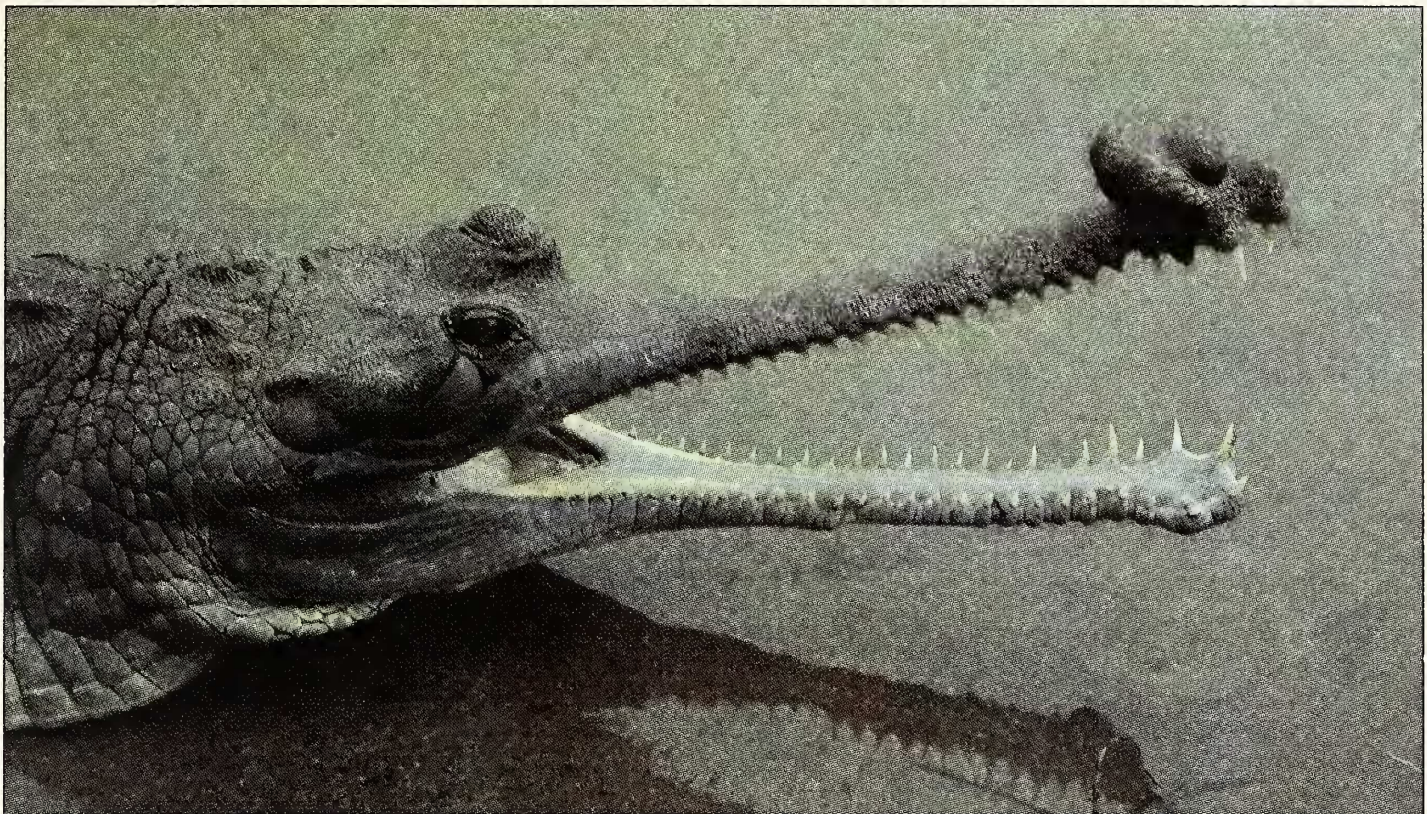
Fig. 1: Historical range and current distribution of the gharial within the Indian subcontinent

10-15 in Pakistan, around 5 in Bhutan and 5-10 in Bangladesh. The gharial is extinct in Myanmar; one was shot on the Maingtha river in ‘Upper Burma’ in 1929 (Smith 1931).

MUGGER

The mugger (Plate 1, Fig. 2) *Crocodylus palustris* is the most adaptable of the three Indian crocodilians and has been encountered up to 400 m in crystal clear hill streams, sewage treatment ponds, cold deep rivers in the Himalayan foothills, oxbow lakes in Nepal and saltpans in southern Sri Lanka. The current and historical range of the mugger is shown in Fig. 2. Surveys in the early 1970s identified Gujarat and Tamil Nadu (two of India’s drier states) as having most of India’s mugger (Whitaker 1987). The present estimated wild mugger population in Tamil Nadu is 465, of which 52% are adults (Andrews 1999b). The reported population for Gujarat is 429 individuals with 88% adults (Vijaya Kumar *et al.* 1999).

Tamil Nadu and Gujarat are the most completely surveyed states for mugger and a look at the comparative data on croc numbers for the



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Fig. 1: Male gharial *Gavialis gangeticus* showing the 'ghara' of a mature animal



BELINDA WRIGHT

Fig. 2: Mugger *Crocodylus palustris* hatching



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Fig. 3: Saltwater crocodile *Crocodylus porosus* nesting



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Fig. 4: In India, most crocodiles are in captivity



Fig. 2: Historical range and current distribution of the mugger within the Indian subcontinent

1970s and the 1990s reveals some definite trends. In general, mugger numbers have increased, due to restocking and protection, and in cases like the Moyar river in Tamil Nadu, simply by doing more complete surveys (Vijaya Kumar and Vyas 1997, Andrews 1999b).

There are fairly stable small mugger populations in the state of Karnataka along the Cauvery and Kabini rivers and in the Ranganathittu Bird Sanctuary. Ranganathittu has approximately 17-20 adults and 10-15 subadults; juveniles and hatchlings are also seen in this Sanctuary (Venugopal 2000). Along remote stretches of the Cauvery river, adult mugger are sporadically seen and the estimated total population along this river is 50 adults. The Kabini river (which originates in Kerala) flows through the Nagarhole National Park and has a small stable population within the protected area. During a preliminary survey, 22 adults were counted by direct sighting. The habitat is pristine, several mugger tunnels and good nesting banks were also observed within the Park (Andrews 1995). Other areas which reportedly have small

mugger populations include the Tungabhadra Reservoir (Bhadra Sanctuary) and Shiva Samudram.

The state of Andhra Pradesh has been involved in crocodile conservation since 1976 and has released over 320 mugger in seven different localities (Vijaya Kumar and Choudhury 1990, Vijaya Kumar 1993, Srinivas *et al.* 1999). Isolated small populations occur in Manjira, Ethyothala and Siwaram Wildlife Sanctuaries, but their present status is unknown.

The estimated mugger population in Rajasthan is around 470, distributed in 11 protected areas (Sharma *et al.* 1999). Ranthambore National Park has the highest with 200 crocs and the National Chambal Wildlife Sanctuary has around 100. In the other protected areas numbers vary from 10-50 individuals. There are increasing reports of human - croc conflict from the Chambal area which calls for immediate education programmes and a Flying Squad to capture and translocate problem animals.

Mugger in Kerala are found in the Neyyar Reservoir, Parambikulam Reservoir and the Nugu and Kabini rivers. Conservation work was taken up during 1977 when the wild population in the State was less than 60, and releases have been done in Neyyar and in Parambikulam. The current estimated population is 259, based on the surveys of 1997 (Pillai 1999). The highest densities are in Neyyar and Parambikulam. The population in Parambikulam is stable and the habitat is still pristine (Andrews, pers. observ.). Currently Kerala has 192 mugger in captivity and has to deal with constant human - croc conflicts in Neyyar Reservoir. The Forest Department has started an education programme and the capture of large problem animals.

In Maharashtra, *C. palustris* were once abundant in all the major river systems and lakes, but were depleted by the 1960s (Gogate 1999). The first author remembers that, at Powai Lake in the late 1950s, a reward of Rs. 50 was offered for killing a crocodile and Rs. 10 for destroying a

crocodile egg, probably by the Fisheries Department. A conservation programme was started in 1977 and reintroduction was carried out up to 1992 in and around protected areas, however there have been no surveys or monitoring, so no information on the current wild population is available.

In Goa, small breeding populations of mugger still exist in several parts, including Selaulim Dam, Opa river and small lakes in the Ciba-Geigy and IOAR compounds. The largest concentrations are found in the mangrove-lined brackish creeks of the Zuari and Cumbarjua rivers. While there has never been any formal release programme, 38 rescued mugger have been released here in the past few years. Unfortunately, crocs are killed by local fishermen and illegal clearance of mangroves has devastated the habitat of the mugger and a myriad other taxa (Alvares and D'Sousa, in press).

Perhaps the most remarkable feature of the mugger situation in India is that while there are less than 2,500 left in the wild (Table 2), there are over 3,000 in captivity at the various State

Government rearing centres and at the Madras Crocodile Bank. Captive breeding and wild egg collection for rearing has been stopped since 1985, because suitable release sites are scarce and so are funds. The entire croc conservation programme came to a halt mainly because sustainable use of the mugger as a resource was not taken up, although it was one of the goals of the GOI/FAO/UNDP project.

Mugger outside India

Sri Lanka: Sri Lanka has a large mugger population probably numbering several thousand throughout the island nation (Whitaker and Whitaker 1979, Santiapillai *et al.* 2000). While the largest numbers occur in two national parks, Yala and Wilpattu, mugger can be seen in large tanks, in rice fields, waterways and small and large rivers in most sparsely populated areas. The mugger is strictly protected in Sri Lanka and a crocodile management and conservation project is being formulated (Whitaker, in prep.). A recent film on the mugger in Sri Lanka reveals unique underwater footage of breeding behaviour and parental care

Table 2: Total wild mugger in India

Location	Estimated numbers released	Estimated wild mugger
Orissa (Simlipal river systems)	350+	65 (based on surveys)
Gujarat	1,000+	429 (based on surveys)
Uttar Pradesh	?	200 (guesstimate)
Andhra Pradesh	320	100? (no recent data)
Tamil Nadu	350+	465 (based on surveys)
Rajasthan	?	470 (guesstimate)
Kerala	50+	259 (guesstimate)
Karnataka	?	150? (no recent data)
Madhya Pradesh	27	134 (based on surveys)
Maharashtra	200	100? (no recent data)
Goa	38	148 (based on surveys)
Haryana	?	20
Bihar	?	? (no recent data)
West Bengal	?	? (no recent data – likely extinct)
Northeastern states	?	? (no recent data)
Punjab	?	? (no recent data – likely extinct)
Jammu and Kashmir	?	? (no recent data – likely extinct)
Total	2,335	2,540 +/-300

Source: ENVIS (Wildlife & Protected Areas) (2)1, 1999; Vijaya Kumar and Vyas 1997; Alvares and D'Sousa, in press.

by the male. Sri Lanka holds the responsibility for the long-term survival of the mugger.

Iran: In Iran, a small number of muggers are hanging on by the skin of their teeth in the southeastern, Baluchestan region. Frazer (2000) has reported areas of riverine and estuarine wetlands, such as the Govater Bay and Hur-e-Bahu (which is a 75,000 ha Ramsar site), as important for *Crocodylus palustris*. Other areas include the Sarbaz and Kajou rivers, where muggers are protected by local folk beliefs (Kami and Saghari 1993). During 1992 surveys, 16 *gando* (= crocodile in Farsi) were counted in the Kajou river and 30 in the 16 adjacent ponds. During the same survey, 72 muggers were recorded in the Sarbaz river and adjacent ponds along it (Kami and Saghari 1994). Mobaraki (1998a) located nests in the Bahukalat Protected Region. Here muggers inhabit small streams and pools, and during the dry months, migrate across the border into Pakistan (Kami and Saghari 1993, Mobaraki 1998b). There is some Government interest in mugger conservation, and select areas are now protected. However, more recent information on current status is lacking.

Pakistan: The mugger of Pakistan was thought to be near extinct, with a few small isolated populations scattered in various areas (Khan 1993, 1994). A captive-breeding programme was started during 1993 and the Government of India supplied gharial and mugger for this programme. However, during 1999 surveys, an estimated population of 500-1,000 mugger has been reported for the Deh-Akro Wildlife Sanctuary in Sindh Province, which consists of 25 lakes formed by the seepage from irrigation channels. There are also reports of crocs in Hingol National Park, the largest park in Pakistan with an area of 619,043 ha (Chaudhury 2000). Currently all the major wetlands in Pakistan are threatened, thanks to the World Bank-aided 'National Drainage Programme' which involves construction of dams and channels, diversion of natural flows, and funnelling agricultural runoffs into river systems (Rose 1998, Chaudhury 2000).

Nepal: In Nepal, mugger have been reduced to small isolated populations mainly in protected areas, such as the Royal Sukla Phanta Wildlife Reserve, Bardia Reserve and the Royal Chitawan National Park. A small number have been reported from the Sapta Koshi area and the Lumbini district. The Mahakali and Bahuni rivers adjacent to Sukla Phanta represent excellent habitat and are contiguous with similar areas in Uttar Pradesh. Surveys by IUCN Nepal revealed depressed numbers in this area. The estimated wild population of mugger is around 200 (Andrews and McEachern 1994). Loss of habitat and construction of dams and barrages has affected *C. palustris* populations and recruitment in the wild. Each year, juveniles and hatchlings, flushed below the barrages (low dams), cannot return during the post monsoon season and usually perish. Conservation efforts in Nepal started in 1978 with wild gharial egg collection for rearing and release programmes. Releases started in 1981 and IUCN Nepal started a programme for mugger in 1992.

Bhutan: In Bhutan, mugger became extinct by the late 1960s and during 1981 a captive breeding programme was started at a centre at Phuentsholing. Mugger from Uttar Pradesh, India, were obtained for this purpose. In May 2000, there was a small group of 17 mugger breeding successfully, and 4 adult female gharial (Whitaker, pers. observ.). Mugger have been released in the Manas river. There is, however, no information on the fate of these animals (Dorji, 1997 and unpubl. data). Extensive surveys are suggested for the Bado, Manas, Sunkosh Torsa, Raidak and the Puna Tsongchu river systems, from where there are sporadic reports of both mugger and gharial.

SALTWATER CROCODILE

The saltwater crocodile *Crocodylus porosus* (Plate 2, Fig. 3) is happiest in undisturbed mangroves, now one of India's most threatened habitats. It is no surprise that the 'saltie' is now a rare reptile in South Asia, and in India restricted

to the Bhitarkanika Sanctuary in Orissa, the Sunderbans in West Bengal and the Andaman and Nicobar Islands, although historically this species occurred all along the west and southeast coast of India (Fig. 3). Table 3 gives the numbers of wild salties in India.

Orissa: In 1976-77, prior to releases, the density of salties in the Bhitarkanika Sanctuary was 0.87 individuals per km of river (excluding hatchlings), there were 29 adults, six subadults and 61 juveniles (Kar and Patnaik 1999). Following this, about 2,000 young crocodiles were released in Bhitarkanika over the next 24 years. Along with the successful restocking of gharial on the Chambal river, the Bhitarkanika saltie project was a dramatic success. In 1998, a total of 672 crocs were counted (including 150 hatchlings, 146 yearlings, 160 juveniles, 144 subadults and 72 adults) for a density of 5.0 crocs per km (Kar and Patnaik 1999). In 2001, a census conducted by the Rajnagar Mangrove and Forest Division came up with a figure of 1,285 salties in Bhitarkanika Sanctuary (Kalpavriksh 2002). The carrying capacity of the Sanctuary is limited by the absence of any buffer zone surrounding it. Any croc straying out of the protected area has little hope of survival. The rearing centre at Dangmal in the heart of the Sanctuary now has about 300 captive salties. Egg collection from wild nests has been stopped there.

West Bengal: The Sunderbans in West Bengal is a vast tidal swamp Tiger Reserve and part of one of the world's largest mangrove ecosystems. The sad part is that there are very few salties in what is ideal habitat for the species.

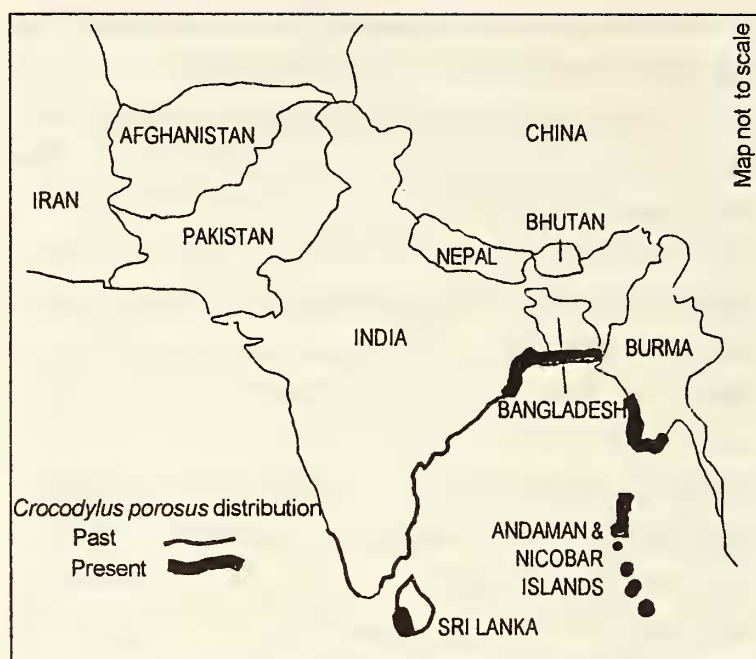


Fig. 3: Historical range and current distribution of the saltwater crocodile around the Indian subcontinent

The Bhagabatur croc project of the West Bengal Forest Department has released 332 young salties in the 1.2-1.5 m size class in the Sunderbans since 1979, but there has been no monitoring or recent census (Chowdhary and Choudhury 1999). A lot of the best nesting habitat (swampy areas where freshwater meets the tidal zone) has been converted to paddy cultivation long ago. The entry of thousands of permit holders into the Reserve to fish, and to collect honey and leaves for roofing creates continuous disturbance.

Andaman and Nicobar Islands: In the Andaman and Nicobar Islands, the mangroves are still largely intact on the seaward side, but the inland portions of North Andaman Island were destroyed for firewood, and saltie nesting habitats used for growing rice (Whitaker and Whitaker 1978, Andrews and Whitaker 1994). Early

Table 3: Total wild saltwater crocodiles

Location	Estimated numbers released	Estimated wild salties
Orissa (Bhitarkanika Sanctuary)	2,000	672 (based on surveys)
West Bengal	332	200? (no recent data)
Andaman Islands	18	196 adults (based on surveys)
Nicobar Islands	Nil	100? (no recent data)
Total	2,350	1,168 +/- 300

Source: ENVIS (Wildlife & Protected Areas), Vol. 2, No. 1, 1999.

estimates of the population in North Andaman were 100-200 animals (Whitaker and Whitaker 1978). Choudhury and Bustard (1979) and Choudhury (1980) estimated that there were 50 breeding females for North Andaman Island. Andrews and Whitaker (1994) recorded the adult population of North Andaman as 95 animals, but a subsequent survey of a single island, Landfall, by Andrews (1999a) turned up 38 adults. Ten nests were located but North Andaman settlers had raided all. There are an estimated 19 adults in Middle Andaman, 19 adults in South Andaman and 27 adults in Little Andaman Island. The total estimate for adults in the Andaman Islands is thus 198 (Andrews 1999a).

Surveys conducted during 2000-2001 in the Nicobar Islands indicate that most of the adults and subadults have been taken by Thai poachers, except in the Galathea creek on the southeast of Great Nicobar island where a stable population still exists. The west coasts of Great Nicobar and Little Nicobar Islands have pristine habitats but population densities comprise very few adults and mostly hatchlings, yearlings, juveniles and a few subadults (Andrews, in prep.). A small population, of all size classes, occurs in the Middle Nicobar group, however the mangrove habitat in this region is very scanty and cannot sustain a large population.

Saltwater crocodiles outside India

Myanmar still has some very small populations and individual *Crocodylus porosus* scattered around the region. Surveys conducted by Thorbjarnarson *et al.* (1999) and Platt (2000) indicate that there are still small, fragmented populations and there is reproduction. Thorbjarnarson *et al.* (1999) reported 10 adults and 100 juveniles plus hatchlings and nests within the Meinmahia Kyun Wildlife Sanctuary, a 136 sq. km island. Outside the protected area, salties are near extinct, with only a few isolated individuals remaining.

Sri Lanka also has isolated populations of *C. porosus*, mainly on the southwest coast which

still has some suitable habitat left. Detailed surveys are required to establish the status and survival potential of this, now rare, species.

The Madras Crocodile Bank Trust

The Madras Crocodile Bank was set up in 1975, for the breeding and rearing of South Asia's three crocodilians, for restocking wild habitats. It is also a research and public education centre. The Bank has achieved these goals with the breeding of thousands of mugger and also gharial and saltwater crocodiles. Close to a thousand crocs, besides eggs, have been supplied for restocking and for breeding programmes throughout India and in Bangladesh. The Bank has generated a number of documentary films, several books and over 600 scientific and popular articles. Over the past quarter century, more than 8 million people have visited the Bank and learned about crocodilians. The Crocodile Bank presently houses over 2,500 crocs of 14 species, snakes, lizards and turtles and is recognised as India's Centre for Herpetology. It is also the office of the Vice-Chairman, West Asia, Crocodile Specialist Group (CSG) of the IUCN Species Survival Commission (SSC). Current ongoing studies include crocodile surveys and habitat assessment, temperature sex determination, growth, behavioral, breeding biology and hormonal research.

DISCUSSION

Up to the 1970s, the three crocodilians of South Asia were in big trouble, due to killing for skins and meat, eating of their eggs and the loss of most of their habitat. In India the GOI/FAO/UNDP Crocodile Conservation Project, the Madras Crocodile Bank Trust, State Forest Departments, and like-minded individuals reversed the decline. About 9,800 gharial, mugger and saltwater crocodiles were released into established as well as newly protected areas in India, and for the first time positive publicity was given to these long feared and maligned reptiles. Data is difficult to

extrapolate from the hodgepodge of non-standardised survey reports from some states and no data at all from others. However, it appears that there is little room for complacency with less than 1,500 wild gharial, 2,500 wild mugger and under 1,200 wild saltwater crocs left in India. There was a certain amount of spin-off from the Indian efforts in Nepal, where the Frankfurt Zoo helped start an egg collection, rear and release programme with advice from the FAO project. A similar start was made in Bhutan. Unfortunately Pakistan, Bhutan, Myanmar, Sri Lanka and Bangladesh have made no substantial conservation effort towards protecting the crocs they had left in the wild.

ACTION PLAN

In India, the IUCN/SSC/CSG Western Asia convened a regional meeting at the Madras Crocodile Bank Trust in 1993 (CSG-India 1993), and in Gwalior, Madhya Pradesh in 1997 (CSG-India 1997) resulting in an Action Plan. Similarly, the three crocodilians are given a place in the South Asian Amphibian and Reptile Specialist Group Action Plan.

Executive summary of the IUCN/SSC/Crocodile Specialist Group Western Asia region - Crocodilian Action Plan

1. Liaison with the Ministry of Environment and Forests, mainly to reconstitute the Technical Committee for crocodile conservation.
2. Research: The action plan identified several priority areas, including a database for wild and captive crocs, management and use. Main research priorities, however, will be continued surveys, monitoring, and identifying potential restocking sites.
3. Publicity and awareness, especially in areas of potential croc - human conflict.
4. Skill development and training.
5. Regional interaction and coordination.
6. Funding.

The outcome of these meetings has been circulated to the Government of India, all State Forest Departments, all regional members, IUCN/SSG/CSG Chairmen and Steering Committee Members.

THE FUTURE OF INDIA'S CROCODILIANS

After such an ambitious and successful beginning to the rehabilitation of India's three endangered crocodilians, it is very disappointing that few of the states involved have sustained some level of interest and action.

Currently there is very little monitoring, management or conservation efforts and studies on crocodiles within India and in the region, and there is an urgent need to revive this interest. It is also vitally important to implement a feasibility study for farming and ranching.

Crocodile conservation becomes necessary because, aside from the obvious value of the skin, meat and other by-products, the crocodile plays a vital ecological role as a master predator in the aquatic habitat where it lives. By preying on weak and diseased fish and animals, it maintains genetic quality; by its habit of selective feeding, it controls predatory fish. Its presence thus actually helps to increase yields of edible fish for man.

While many developing countries have found to their dismay that crocodile populations are remarkably easy to exterminate, crocodiles have responded well to protective management initiative, wherever adopted. Crocodile (and alligator) ranching, farming and rehabilitation programmes have been underway in several countries for a number of years. Most of these have been successful in maintaining wild crocodile populations and protecting millions of acres of wetland habitat, besides generating income for local people.

The programmes vary from country to country in dramatically different scenarios, from outright licensed hunting of adult alligators (as in Louisiana), to closed cycle captive breeding

(South Africa) and collection of eggs in the wild (Australia and Zimbabwe). Two things are common to all of these wildlife management operations: (a) local people (often tribal people) are making a good economic return, and (b) wild crocodile populations are doing well.

The Indian experience in crocodile conservation and rehabilitation in the last 25 years has been very encouraging. However, persisting with a simplistic policy of bans and attempts to preserve wildlife for its own sake, has again put crocodiles in the region under grave threat. Here, conservation is anti-people and the alarming decline in all our major wildlife species is the tragic result. No single conservation strategy can solve the problems faced by wildlife in India and it is vital that we continue to test new and innovative conservation methods — even if it means upsetting some people. Most opponents of sustainable use of wildlife are more interested in protecting the principle of “preservation” rather than trying to solve our problems of dwindling wildlife. Fundamentalist belief in the animal welfare movement and lethargy on the part of some key government bureaucrats are two reasons why conservation cannot

achieve in India what so many other countries have accomplished.

In many countries, conservation through sustainable use is a strategy that has proved remarkably effective in saving wildlife and involving the people in it. It is essential that India too looks at all the various conservation options, including sustainable use of wildlife if we are to effectively conserve crocodiles and their dwindling habitat. Crocodile farming has done wonders for the crocodilians in many developing countries and India is lagging way behind.

Most captive crocodiles in India are now several generations removed from the wild (Plate 2, Fig. 4). They are no longer wildlife, they are domestic reptiles in the same way chickens, sheep, cows and pigs were once wild and have been domesticated by humans. Wildlife utilisation is already being practised on a massive scale by India's fishermen, tribals who collect minor forest produce and by the Irula Snake Catchers' Cooperative, whose members catch snakes to produce life saving antivenin. Crocodile farming can now point the way to a new and dynamic approach to managing wildlife — before we have lost everything.

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